Classical and Quantum Gravity 2010 vol.27 N9

Trapped ghosts: A new class of wormholes

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Abstract

We construct examples of static, spherically symmetric wormhole solutions in general relativity with a minimally coupled scalar field whose kinetic energy is negative in a restricted region of space near the throat (of arbitrary size) and positive far away from it. Thus in such configurations a 'ghost' is trapped in the strong-field region, which may in principle explain why no ghosts are observed under usual conditions. Some properties of general wormhole models with the field are revealed: it is shown that (i) trapped-ghost wormholes are only possible with nonzero potentials V(); (ii) in wormholes with two asymptotically flat regions, a nontrivial potential V() has an alternate sign and (iii) a wormhole with two asymptotically flat regions which is mirror symmetric with respect to its throat has necessarily a zero Schwarzschild mass at both asymptotics. © 2010 IOP Publishing Ltd.

http://dx.doi.org/10.1088/0264-9381/27/9/095022